CLAIMS

What is claimed is:

1. A method of encoding/decoding a block of quantum data comprising:

removing trailing eigenstates from said block that have eigenvalues below a predetermined limit to retain leading eigenstates that have eigenvalues above said predetermined limit; and

encoding said remaining quantum bits retained in said block after said removing.

2. The method in claim 1, wherein said remaining quantum bits comprise a linear superposition of said leading eigenstates.

3. The method in claim 1, wherein said predetermined limit is based upon a density matrix of said block.

4. The method in claim 1, wherein said encoding produces encoded quantum bits, said method further comprising decoding said encoded quantum bits by reversing said encoding.

5. The method in claim 4, wherein said decoding reproduces said remaining quantum bits.

6. The method in claim 1, wherein said encoding completely erases said remaining quantum bits.

7. The method in claim 4, further comprising outputting only an encoded or decoded result.

8. A method for block compression of quantum information comprising:

projecting a block quantum state into a typical subspace comprising a plurality of eigenstates;

encoding said subspace using an encoder; and

decoding said subspace using a decoder.

9. The method of claim 8, further comprising:

generating said block quantum state using a quantum memoryless Bernoulli source.

10. The method of claim 8, wherein said projecting of said block quantum state into said typical subspace comprises:

analyzing a plurality of eigenvalues contained in a density matrix associated with said block quantum state;

determining a plurality of largest eigenvalues;

spanning said subspace, wherein said eigenstates are associated with said largest eigenvalues to produce a spanned subspace; and

projecting said block quantum state into said spanned subspace, to produce a projected block quantum state that lies in a low dimensional typical subspace.

11. The method of claim 8, wherein said encoder and decoder are quantum-mechanical inverses of each other; and

said decoding is achieved by performing said encoding in reverse.

12. The method of claim 11, wherein said encoding comprises using a fixed-rate quantum Shannon-Fano code to compress said projected block quantum state, wherein compression occurs at a per symbol code rate that is slightly higher than a von Neumann entropy limit.

13. The method of claim 11, wherein said encoding comprises:

creating a representation quantum Shannon-Fano code as a plurality of quantum arithmetic codes; and

using said plurality of quantum arithmetic codes to compress said subspace containing said projected block quantum state.

14. A method for block compression of quantum information comprising:

projecting a block quantum state into a typical subspace comprising a plurality of eigenstates;

encoding said subspace using an encoder.

15. The method claim 14, further comprising:

generating said block quantum state using a quantum memoryless Bernoulli source.

16. The method of claim 14, wherein said projecting of said block quantum state into said typical subspace comprises:

analyzing a plurality of eigenvalues contained in a density matrix associated with said block quantum state;

determining a plurality of largest eigenvalues;

spanning said subspace, wherein said plurality of eigenstates are associated with said largest eigenvalues to produce a spanned subspace; and

projecting said block quantum state into said spanned subspace quantum state that lies in a low dimensional typical subspace.

17. The method of claim 14, further comprising using said encoder in reverse, to decode said subspace.

18. The method of claim 16, wherein said encoding comprises using a fixed-rate quantum Shannon-Fano code to compress said projected block quantum state, wherein compression occurs at a per symbol code rate that is slightly higher than the von Neumann entropy limit.

19. The method of claim 16, wherein said encoding comprises:

creating a representation quantum Shannon-Fano code as a plurality of quantum arithmetic codes; and

using said plurality of quantum arithmetic codes to compress said subspace containing said projected block quantum state.

20. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform a method for block compression of quantum information comprising:

projecting a block quantum state into a typical subspace comprising a plurality of eigenstates;

encoding said subspace using an encoder; and

decoding said subspace using a decoder.

21. A program storage device as in claim 20, further comprising:

generating said block quantum state using a quantum memoryless Bernoulli source.

22. A program storage device as in claim 20 wherein said projecting of said block quantum state into said typical subspace comprises:

analyzing a plurality of eigenvalues contained in a density matrix associated with said block quantum state;

determining a plurality of largest eigenvalues;

spanning said subspace, wherein said eigenstates are associated with said largest eigenvalues to produce a spanned subspace; and

projecting said block quantum state into said spanned subspace, to produce a projected block quantum state that lies in a low dimensional typical subspace.

23. A program storage device as in claim 20, wherein said encoder and decoder are quantum-mechanical inverses of each other; and

said decoding is achieved by performing said encoding in reverse.

24. A program storage device as in claim 23, wherein said encoding comprises using a fixed-rate quantum Shannon-Fano code to compress said projected block quantum state, wherein compression occurs at a per symbol code rate that is slightly higher than a von Neumann entropy limit.

25. A program storage device as in claim 23, wherein said encoding comprises:

creating a representation quantum Shannon-Fano code as a plurality of quantum arithmetic codes; and

using said plurality of quantum arithmetic codes to compress said subspace containing said projected block quantum state.